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AVIATION WEEK

A MCGRAW-HILL PUBLICATION

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•
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Laboratory Frost Coats F-105



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Ignition



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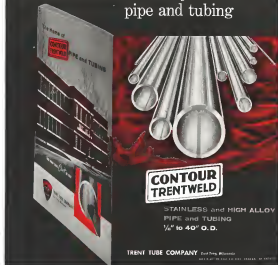
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AVIATION CALENDAR

(Continued from page 5)

- Jan. 20 Feb. 7—Aviation Institute for General Motors and Boeing Plants, Univ. of Southern California, Los Angeles
- Jan. 22-24—First International Air Show & Exposition, Marine Field, Miami. For details write: P.O. Box 2578, Miami 37
- Jan. 27-30-1961 Annual Meeting, Institute of the Aeronautical Sciences, Sheraton Hotel, WTC, Houston. Night Dinner, Jan. 29
- Jan. 29-31—Fourth Annual Meeting, American Astronautical Society, New York, New York, Rm. 300, 200 W. 4th St., N.Y.C.
- Jan. 30-31—American Society for Engineering Education 1961 College Industry Conference, U. of Michigan, Ann Arbor
- Jan. 30-31—Seventh Annual Instrument Show, sponsored by Southern California Motor Association and Los Angeles Harbor Junior College, at Los Angeles Harbor College, Wilmington, Calif.
- Feb. 1-4—Industry Service Symposium (Flight Control Panel), Longmont, Colorado. Details: Dayton Ohio. For details, Mr. J. H. Kaurer, Box 942, Dayton
- Feb. 15—San Diego, Section: Fuel & Turbine, Dr. Hugh Weiss, Models and Ordnance Systems Department, GE, Eastern Club, Philadelphia, Pa.
- Mar. 18-19—Second National Conference on Aviation Education, Hotel Marlboro, Washington, D.C.
- Mar. 17-20—First Aviation Conference, American Rocket Society, American Society of Mechanical Engineers, Sheraton Hilton Hotel, Dallas, Tex.
- Mar. 17-21—1961 Nuclear Congress, sponsored by American Institute of Chemical Engineers, 25 W. 41 St., N.Y.C.
- Mar. 18-19—First International and Industry Symposium on Guided Missile Training equipment (designed to discuss Soviet equipment), Naval Ordnance Laboratory, White Oak, Silver Spring, Md. For details write: Mr. J. C. Vack, Head of New Weapons & Systems Division, U.S. Naval Training Service Center, Fort Washington, C., N.Y.
- Mar. 24-25—Fourth International Instrument Show, Center Hall, London
- Mar. 30-Apr. 1—RFG RWAS, Reno (World War II, Toronto, Canada Convention, C. B. Manning, Chairman, 19 South Drive, Toronto 5
- Apr. 4-10—Eight International Symposium, Cleveland, Wisconsin. For details write: Institute of Aerospace Studies of the University of Toronto, 180 St. George St., Toronto 5, Canada
- Apr. 14-16—National Instrument Meeting, American Welding Society, Board Studies, St. Louis, Mo.
- Apr. 16-19-1961 Annual National Forum, American Gaslighting Society, Sheraton Park Hotel, Washington, D.C.
- Apr. 17-18—Institute of Environmental Engineers Second Annual Symposium Meeting, New York, New York
- Apr. 22-24-1961 Electronic Components Conference, Anderson Hotel, Los Angeles, Calif.
- Sept. 1-7-1961 Flight Display and Exhibitions, Society of British Aircraft Constructors, Farnborough, England

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Voodoo Brings Home the Bacon

Hearst congratulations are due McDonnell Aircraft Corp., Pratt & Whitney Aircraft and Air Force Maj Adrian Dwyer for bringing back the official world speed record to the U.S. with a 1,207.6 mph average speed over the Edwards AFB official record course in the F-101A. The performance when homologated by the Federation Aeronautique Internationale will bring the world speed record back to the U.S. from Great Britain where it has resided since March, 1956, as a result of the 1,132 mph performance of Peter Twiss in the Fencer F2 Delta research aircraft.

At the time the British captured the second from the North American F-101A, we wrote some letters—intended in no way to detract from the superb performance of the Fencer Delta and its pilot—criticizing the U.S. Defense Department policy of refusing to allow U.S. military aircraft to participate in world record breaking efforts.

Long-Time Capability

We noted then that there were already five USAF and Navy planes well along in flight testing that were capable of topping the 1,132 mph British mark, and the F-101 Voodoo was one of those specifically mentioned.

At that time, some of our British friends were a bit skeptical of our claims, largely on the legal meaning too that, if we had such planes, we would surely not want in making down the record. They, fortunately, were not acquainted with the strict head in the neck policies of the former Defense Secretary, Charles E. Wilson or the even more ridiculous public relations policies of his then deputies in this department, Karl Hoessner and Robert Tripp Ross.

Consequently, we are delighted to be able to offer concrete proof of our original thesis in the performance of Maj Dwyer and the McDonnell F-101A. To get the proper time reference, it should be emphasized that the F-101A has been in service with operational units of the Tactical Air Command for more than a year and was quite capable of its currently recorded performance even longer ago.

Production Line Aircraft

The F-101A that set the record was a standard production line aircraft from an operational fighter bomber wing of Tactical Air Command. It is an aircraft with no new and no very moderate used aircraft bench. Although it would be naive to assume that some special "tuning up" was not done on this particular aircraft and its two Pratt & Whitney J57 turbojets for the record attempt, this speed mark was set with an aircraft that is essentially a fighting machine, not a racing craft.

It is also interesting to note the Soviet Union's attempt to get into the world speed record act with a

heavy environment that one of its fighters reached 1,242 mph on a routine test flight by Lt. Col. Nikolai Kozlovskiy. The Soviets did not identify the plane by type but it could have been any one of several new Russian designs without showing our technical credibility. Another source reported as long ago as July, 1956, that the Soviet MIG-21 Foxbat (AW July 30, 1956, p. 33, Dec. 16, 1957, p. 67), which we observed in flight at Yonkers, was in the 1,200 mph speed class. Both the Frijolito delta series of Pavel Sukhoi and the rocket-powered interceptor in Red air force service are also capable of speeds in excess of 1,200 mph.

The interesting angle on the Soviet quick jump into print with Kozlovskiy's unofficial performance was their sensitivity on the international prestige aspect of superior technical performance. This was a point the former regime in our Defense Department could never grasp and, as a result, our prange in the field took a severe and undesired bump during their frozen tenure.

It is also interesting to note that the Soviets have been steadily flagging official claims with the FAI for a wide variety of helicopter world record performances. We would not be surprised to see them make an officially recorded attempt to meet the absolute speed record now from USAF and the F-101A.

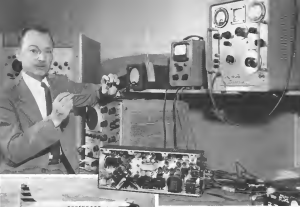
Recapture Altitude Record

There is one other item on the world record agenda that should be dealt with as soon as possible. That is the recapture of the altitude record held by Britain for many years and pushed last summer to 76,000 ft. by a Canberra bomber piloted by two Nigeri Scorpion pilots.

In this category it must be cordially admitted that, for a long time, we had no aircraft or engine capable of meeting the mark from the British. But we now have at least two fighters that can top the Canberra/Scorpion mark. They are the Lockheed F-104A and the Grumman F11F-1F, both powered by the General Electric J79 turbojet. Both of these aircraft already have flown well in excess of 70,000 ft., and it would be a no genuine military security to permit them to do so for the official altitude record.

We are pleased to see both USAF and Navy taking a more active interest in the prestige of official records. The Navy's splendid performances with its carrier-based Vought F4U-1 Consider have now been eclipsed by the USAF run with the F-101A, and both our domestic confidence and international prestige have been bolstered by this spirited and technically sound rivalry. Let's keep it up.

—Robert Holt



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WHO'S WHERE

In the Front Office

Donald K. Tades, a vice president, New South, South Co., Van Nuys, Calif.
Stanley Gervais, vice president and assistant to the president, for Transport Aviation, Wellington, D. C.
James C. Clegg, vice president and chief engineer, and Arthur E. Myers, sales manager, Condor Research Corp., subsidiary of Matthews Electric Manufacturing Corp., Syracuse, Ind.

Zelle E. Smith, vice president and director of engineering, Foster & Reedfield, Inc., subsidiary of American Machine & Foundry Co., Peabody, Mass.

Capt. Jack E. Goldberg, vice president operations, New York Airways, Inc., New York, N. Y.

Ted Starowick, a corporate vice president, Cleveland Pneumatic Tool Co., Cleveland, Ohio.

Dr. Robert M. Page, director of Research, Naval Research Laboratory, Washington, D. C.

Col. James W. Anderson, Jr. (USAF), military special assistant to the chief of staff, The Magazine Co., Fort Wayne, Ind.

Louis W. Davis, executive William G. Key as assistant to the president, Fairchild Engine and Airplane Corp., Hempstead, Md.

Dr. Walter R. Dornberger, technical assistant to the president, Bell Aircraft Corp., Buffalo, N. Y.

Robert J. Norris, administrative assistant to the vice president of engineering and maintenance, Pacific Maritime Airlines, Inc.

Honors and Elections

Ray T. Sherry, chairman and president of Curtiss-Wright Corp., has been elected to New York University's Board of Trustees.

Francis L. Howe, president of Aircraft Corp., has been elected president of the Aviation Distribution and Manufacturing Association, Philadelphia, Pa., and Dr. H. H. Edwards, of Continental Motors Aircraft Division, and Fred A. Kennedy, of South-west Aviation, have been elected vice presidents.

Changes

Clair Hopkins, manager Detroit, Ohio, corporate office The Martin Co. Baltimore, Md.

T. R. Just, administrative engineer testing division, Engineering Dept., Douglas Aircraft Company, Inc., Santa Monica, Calif.

George E. Ellis, industrial products manager, Shinto Division, Fairchild Engine and Airplane Corp., New Rochelle, N. Y.

Robert D. Davis, manager engineering department, Research and Advanced Development Division, Avco Manufacturing Corp., Livonia, Mich.

Thomas S. Melrose, sales assistant to the president, Appleton Science Corporation of Peabody, Massachusetts, N. Y.

Edward L. Snyder, manager semiconductor plant, Motorola Electric Products, Inc., Woburn, Mass.

INDUSTRY OBSERVER

►Bell BQM-107 hypersonic glider project (AW Dec. 2, p. 28) would either double wall construction to solve problem of aerodynamic heating. These quarter inch gaps between inner and outer walls would be filled with Kevlar which would be used both as a coolant and as a fuel. Bell has made 652 preparations to the makers on this project without obtaining a decision. North American Aviation also is accepting double wall construction ratio in its X-15 high-altitude research aircraft.

►Lockheed Missile Systems Division is testing approximately 15 different shapes in its Polaris fleet ballistic missile program. The various shapes are now being evaluated as scale models, probably in very high speed wind tunnels. Nose cone tests are being conducted with scale models in shock tubes.

►Aerospace, after considerable debate over whether to use JP-4 or kerosene in their jet aircraft, have decided on the latter. Current will use ASTM Type A which has a freezing point of -50°F. Decision probably will be formally settled by the technical committee of the International Air Transport Association. Petroleum company sources say a pound lighter for the cost of the kerosene in quantity would be 15 cents per gal. This compared to the usual figure cost of 16 cents per gal. for 100/130 crude gasoline used in most of today's petroleum products. There also is a tax on gasoline which does not apply to kerosene.

►Internal guidance system for Air Force Thor intermediate range ballistic missile reportedly can accommodate repeat thrust variations seven times greater than that of the internal guidance system used on Army's Jupiter IRBM.

►Sikorsky is testing metal for a new, company-financed helicopter designated the S-63. Helicopter will have a flying hour limit on the order of the S-61 (AW Oct. 7, p. 23) but will approximate the S-55 in weight class.

►Two engineers are studying increased attraction from rocket propellant research groups. Jet Propulsion Laboratory of California Institute of Technology has purchased 75,000 lb. of nitrogen tetroxide, a very dense liquid which was previously used in 300 lb. kits. Amer Chemical Corp. has ordered 400,000 lb. of chlorine trifluoride, which is a more efficient oxidizer than those now in use and much easier to handle than fluorine.

►Advance design characteristics of Northrop's T-38 supersonic trainer have been successfully flight tested through use of variable stability aircraft at National Advisory Committee for Aeronautics' Ames Aeronautical Laboratory, Moffett Field, Calif. Variable stability aircraft used for the test was a North American F-106.

►Sanborn Aviation Division of Sanborn Machine Tool Co., Rockford, Ill., has acquired American Machine & Foundry Co.'s Turbo Division in Pasadena, Calif. Turbo Division, one of 16 prime contractors in the ballistic missile program, is building auxiliary power supplies for both ICBM and IRBM projects. Earlier sale was made to Sanborn's, after hidden—including Thompson Products Inc.—were involved in negotiations with American Machine & Foundry for purchase of the division.

►Cessna B-55 Hunter agencies' bowler suffered landing gear damage recently when bender malfunctioned on landing at Kirtland AFB, N. M. Aircraft, with gear attached, had taken off on test flight, but failure of telemetry forced the aircraft to return to its base. Touching down at a high gross weight. Corner test pilot W. W. Wadell, sole aircraft down 90% of the runway before running it off the end and more serious damage that would have been caused by going off the end of the runway. Crew was shaken up but unhurt. Fuel, which has a base value starting at \$270,000, was endangered.

►Douglas' El Segundo Division is developing an airborne missile that will be controllable as flight by pilot of the mother aircraft.



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Washington Roundup

U. S. Atomic Secrecy

Congress is ready to open the door for disclosure of technical atomic information to NATO nations as a top order of business when sessions begin next month. The 1960 Atomic Energy Act, written in the period of a U. S. atomic monopoly, bans any disclosure...

There appears to be general agreement on a basic first step—reopen the legislative ban and widen the disclosure of technical atomic information a matter of executive discretion, along with all other types of defense information.

But there are still congressional apprehensions. Congressmen want what strings should be attached to the general proposal is expected.

New York's Rep. Kenneth B. Keating, leading Republican member of the House Defense Committee, wants a manifestation of security safeguards among the NATO nations as a pre-condition to free interchange of atomic information in the interest of mutual scientific advancement.

A study prepared for the Joint Committee on Atomic Energy by Thomas E. Moore, a former member of the Atomic Energy Commission and now a consultant to the congressional committee, recommends a five-step approach. It lists: "In the first phase, the exchange should be limited to technical data on small weapons. The value of withholding this information from friendly nations has diminished to the point where it ought to give way to higher considerations of unity in the common defense. However, there should be a postponement of three to five years of the second phase of exchange, which would be concerned with large weapons. The value of secrecy with regard to the science and technology of large weapons still remains paramount, at least for the time being."

Nixon: 'Can Spend'

There is new evidence that Vice President Richard M. Nixon is pushing the bill for the money to fund a public education program on the economy for an all-out U. S. effort in missile and space technology (AW Dec. 16, p. 25).

Nixon made a surprise appearance last week at an Air Force Arms seminar conducted as a public session to educate newspaper reporters, newspaper writers and radio television men on the intricacies of the missile race. Contrary to the disclosure had done not those months ago by Republican spokesmen Nixon and the U. S. "can spend all we need to spend" for national defense the applicant for full maintenance of the Strategic Air Command and the missile, are mainly, related to political battle for U. S. interests in the ballistic field.

Nixon seemed an confident impression on the past, showed signs of sound judgement by his short speech, which was delivered without notes at first. Most impressive of all, he exhibited understanding of the military, industrial and public relations problems involved in getting the U. S. on the road to progress.

Astronautics Cast

Contrary to the general opinion, Richard Horner, Assistant Secretary of the Air Force for Research and Development, does not believe that the astronautics industry budget-breaking chances. Horner told the Sen-

ate Preparedness Subcommittee that the work can be done adequately.

A small investment, he said, can turn USAF's existing industrial plants, technology and test facilities to the production of emergency space.

Soviet Trims Bureaucracy

It hasn't been widely published, but Moscow has shaken up its scientific organization in definite preparation for war. Four institutes concerned with defense production have been abolished and replaced by a State Committee on Defense, Techniques headed by A. V. Domachev, with a staff of four and a number of assistants. This is a paradox for Domachev, who was Minister of Defense Industries.

Domachev even made important in the fact that the Atomic Industry Ministry was wiped out, replaced by a "State Committee" that operates on a higher level in a kind of Peter Dneprovsky, former minister of the aviation industry.

Western observers assume the Russian changes are designed to clear old tape oblige, speed weapons to the firing commands.

Bilateral Fears

Airfrans are becoming alarmed for the third time this year over the manner in which the State Department is negotiating its transport agreements with design countries. Current situation results from talks now being conducted with France.

A representative of one U. S. international carrier said U. S. airlines have not yet been informed of just what France is asking, although the French have indicated publicly that they want a route to the U. S. West Coast and a Polar route to the Orient. The spokesman and the State Department, after standing pat against the sounding of new routes to France earlier, may be rolling in "give in" on a West Coast route. The Civil Aeronautics Board is willing to go along with State on that matter pending the October 1961 decision.

Another spokesman said last week's apparent willingness to give France at least one additional route has been "understanding" for the NATO conference in Paris.

CAB: Space Denial

Civil Aeronautics Board is at least one government agency that hasn't yet brought the idea of space flight. In denying the first extended fiscal application for interplanetary space travel, the Board ruled that impact per acre "since at the present time no commercial enterprise is available and there is no indication as to the present feasibility of such service or traffic which might meet its needs beyond the earth."

The fiscal application for authority to operate a space carrier between the U. S. and points in the universe was filed recently by Transworld Transport Co. Inc., of Atlanta. The Board chose to follow the committee's recommendation that pointed out that the applicant failed to designate routes and terminal or intermediate points on the proposed routes. The committee also emphasized by its recommendation was based on past space the applicant's failure to discuss the type of space machine he proposed to use.

—Washpost and

Pentagon Girds for New Research Feud

Military services are ready to battle for control of R&D with less Defense Department interference.

By Claude White

Washington—New battle over the direction of research talent and funds in order war in the Pentagon with five military services ready to fight for control with less interference from Defense Department managers.

Military research and development spokesmen in the armed forces already are starting to receive support from some important defense contractors.

The light was coming upon them last week in the Pentagon when they announced the choice of last spring when the Defense Science Board released against the conservative distribution of Frank D. Newberry, the Assistant Secretary of Defense for Research and Engineering (AWA 415, p. 28).

Grains of the civil conflict was an announcement by Defense Secretary Neil H. McMillan that he will establish a new Advanced Research Projects Agency—a single agency to manage the universe inside space flight and other "upstream" projects. This agency, McMillan indicated, will carry on research and development, turning out the new weapons by using only the funds already in the defense budget (AWA 415, p. 26).

Attack by Kissell

Most spirited attack on the McMillan concept was made last week by Sen. Dan A. Rostenkowski, Assistant Secretary of the Navy and now president of Aerojet-General Corp., manufacturer of rocket engines for guided missiles.

These programs, Kissell said, are "American Rocket Society's problem," and clearly military and the making of rockets, not to an Advanced Research Projects Agency.

"Any research agency which would try to squeeze all these plants of missile development would only introduce confusion, delay, unnecessary delays and waste and products from the open market point of view."

"What we need is not to match our other high level organizations as a new line of organizations at high level—no organizations which will simplify, not duplicate, the task of existing and free the addition to our missile programs."

"We need a system which will support our own industry."

Kissell made it clear he was talking about advanced research, beyond the weapons and military systems.

At the working level, where the in-

terference of McMillan's decision was not clear to be involved, USAF was the first of the armed services to run out of the Defense Department program.

Holday Raps USAF

Annual of an attempt to "push the envelope" in the next-generation field of space flight, the Air Force has been withdrawn its role setting up a Directorate of Astronautics in the office of the Deputy Chief of Staff for Research and Engineering (AWA 416, p. 21).

Cloning that the action "jumped the gun" was made by the Defense Department's Director of General Affairs, William M. Holday, before the Senate.

Double Management Perils

"The multiple and cross response program which are not aligned with research, hardware, facilities and trained people. The action of these new centers in each program in the Air Force Institute missile programs, when the effort has been to develop hardware, production facilities and to train personnel for operational duties in parallel."

"Double management by the services and by the Department of Defense—this is confusion and inefficiency. Thus a sharp present picture is shown in research—whereas at higher level to the government and loss of quality in the end product."

"The Department of Defense was originally founded by Secretary Forrestal, who saw one of the principal advantages of aviation, at a small organization of perhaps 100 persons who would set policy for the Military Departments."

"It has grown into a swampy of more than 1,000 persons who are taking on the job of reviewing and deciding whether the services are doing or propose to do."

"By the time growth and things of three-to-five hundred people together, as they need to be—more money by studying and keeping program with every least feeling of the wind of Russia propaganda, we have lost track of the goal of effectiveness and we are devoting ourselves and money to trying to find other ways to work."

"To be specific—I think we should set up an organization to meet our needs today, tomorrow and in the long term to come."—Dan A. Rostenkowski, president, Aerojet-General Corp.

Propaganda Subcommittee Admired, adding that the information field is outside his jurisdiction, Holday said he still opposes the cancellation of USAF's activity at this time.

In fact, USAF was the first of the armed services to run out of the Defense Department program. It has not been established nor a director chosen to lead it. In the absence of Defense Secretary Neil H. McMillan, in charge of the NATO members, Holday took his cue to Deputy Defense Secretary Donald A. Quarles and was immediate support. Quarles had asked USAF to establish the new directorate.

In self-defense the major signal in Lt. Gen. Donald L. Pratt, USAF deputy chief of staff, development USAF called it "paranoia." Secretary James H. Douglas declared the action was the result of a misunderstanding and contrary to a promise he had made that nothing would be done until it could be, consistent with the plan for ARPA.

The Air Force Secretary and the purpose of the new directorate was to be in a state of a "stand-by" ARPA, but it was not made clear why USAF's consideration of "upstream" projects must merit formation of the new and apparently unpopular defense agency.

USAF Oppositive

Almost immediately after the Air Force report, criticism from Air Force headquarters made it clear to the Senate Subcommittee. Subsequently, they took with defiance on Advanced Research Projects Agency.

Then Douglas, asked why all three services need separate research and development programs, pulled no punches in his reply.

"You only get support effort from the staff and prospective user. You never get effective present effort when you have the user expressing the need" and doing the work.

Douglas said he had no objection to having basic research done elsewhere, "but once you move over the point of defense law to applied research, I would object."

The Secretary was supported recently by his military colleagues.

Sen. Lt. Gen. Clarence S. Ivins, deputy chief of staff, retorted:

"What we don't need in Washington are more committees, more directorates, more research—we need more decisions from the Secretary of Defense."

Gen. Ivins said the Secretary should limit out rules and resources and, if they are not saved out, "track back."

Gen. Pratt, who noted the views of USAF's new Directorate of Astronautics, said that by the secretary of

he thought a similar agency should be established to bring new weapons into the system. He said he did not, and continued.

"An attempt because more complex it is absolutely necessary that the new development concept proceed having support from program of basic research."

The general said he formed a civilian agency to develop protection and then view the armed forces what they will do would stretch out the time period of development."

Negative by Schriever

The same point was emphasized by Maj. Gen. Bernard A. Schriever, commander of USAF's Ballistic Missile Division. He said:

"If you can separate research and development of military systems from the air war are going to stretch the time of development."

Gen. Schriever said he would be agreeable with the "black group" a strong negative against ARPA. "This would be a very great mistake."

In the month that has elapsed since McMillan announced his intention of creating the new single management agency, there has been nothing to clarify his plan or give more details. In his testimony, Holday indicated that the ARPA effect will create funds and that the armed services will continue to work on their own research and development programs.

Thus a contrast, in the opposition given by McMillan, a month ago. At that time, he said the single agency will establish a head of research, research and development effort with three people who have been working in these areas in the past as the result.

Need for Decision

On this subject, Kissell is a veteran of many years' experience in the Pentagon, recent a firm opinion in his speech to the Rocket Society.

"The Armed Services don't need more and more overlapping agencies."

We need decisions—decisions that start in the Defense Department."

"We need to have basic decisions implemented by the military services, we have a whole jodge of Department of Defense people trying to adjust the military programs."

Then Kissell spoke about a top level research and development staff.

"Research and development staff organizations require a better look and competent technical and management staff."

Such a staff does not exist in the Department of Defense and obtaining such a staff should be defined and time consuming.

A research and development organiza-

tion has no place in the Department of Defense, where it duplicates the separate efforts of the armed services. Kissell said he would like to propose a program to "put America on the road to missile supremacy" and replace "the leadership in which we're losing it."

He and the appointment of Dr. James H. Doolittle as president of the Massachusetts Institute of Technology, as a special assistant to President Nixon, lower was a good starting point but we need more than just to do it, he said. Kissell said he would like to see the Secretary of Defense.

• Dr. Doolittle and his scientific advisors should set missile policy for a Directorate of Guided Missiles.

• Director of Guided Missiles should be appointed to the Director's office, to be in charge of a specific period of years. He should work for the Secretary of Defense.

• Only a small staff is needed by the Director of Guided Missiles to control

the work of the armed services, but not do it for them. The director must not be the mere of end advisors whose opinions are outweighed those of the military men.

The rocket maneuver and sufficient money being spent on advancing the state of the art.

Stepping into the current problems of the Two and Jupiter intercontinental ballistic missile production units, Kissell indicated that he does not believe the Army should be allowed to produce Jupiter for USAF use.

He said the Director of Missiles should have authority to eliminate types and missions and allocate development and production to the services which will be responsible for operation.

For Congress, he urged a simplification of legislation concerning creation of facilities and procurement methods to make it easier for industry and government to get together.

Congress to Boost Defense Budget Above Administration Requests

By Everett Clark

Washington—Subcommittee members of the Fiscal 1970 military budget—even beyond what the Administration will request—cutting as much as 10 percent of the Defense Department's budget. The House subcommittee investigating the committee's extensive look at missile and satellite programs.

Legislation are expected to range from the missile arms to even aircraft, submarines, weapons and defense systems, research, operating funds and personnel.

Major points developed thus far in questioning of military and scientific

committees for administration of "Tide" (NSA) program had not yet been approved by Defense Department when Air Force witnesses testified.

Subcommittee Chairman Lindsay Johanson (D-Tx.) also is Senate majority leader and chairman of the Appropriations and Armed Services Committees. He has previously passed military witnesses for specific services on their needs and has assured them of his willingness to make sure that the needs are filled.

Appropriations committee members of the



GEN. CURTIS E. LEMAY



STATIC test firing of Canaveral Atlas B test launch at Edwards AFB, Calif., shows large boost from main engines, smaller boost from vernier engines.



SEQUENCE of Atlas B test launch at Cape Canaveral. This shows details of configuration.

USAF Reports

Washington—The USAF Center for Astronautical Ballistic Missile Test made its first successful test launching from the Air Force Missile Test Center at Cape Canaveral, Fla., on the fifth anniversary of the Wright Brothers first engine flight.

Only a few hours before the Atlas shot, J. R. Dempsey, director of the program for Center, said he was enjoying a call from the Defense Department to launch a satellite weighing from 500 to several thousand pounds.

The Atlas propulsion system, Dempsey said, can be adapted for the satellite in less than a year.

The Florida test announced at the Pentagon was not a full flight over a 5,000 mile course. The Atlas was reported to have flown a little less than 500 mi. for a test of routine test powers. The results were satisfactory.

The missile had failed on two other attempts in June and September.

Speaking at a missile seminar held by the Air Force Association, Dempsey ex-



... Clearly visible are two exhaust plumes of two rocket engines, nozzles of the engines and protection on lower end of missile—Atlas B planing on external guidance package.

Successful Atlas Launching

noted that the cost of the Atlas, once it is in production, will be about \$2 million. This is without consideration of the money involved in research and development.

Mr. Gen. Bernard A. Schriever, commander of USAF's Ballistic Missile Division, told the Senate Transportation Subcommittee the day of the firing that he is completely confident the Atlas may pose problems has been solved, based upon extensive ground tests and tests with the X-17 missile.

He also indicated guidance and propulsion problems are well in hand.

The Atlas, Schriever says, was reportedly operated satisfactorily during last week's firing.

Atlas is 53 ft. long and 10 ft. in diameter (AW Sept. 2, p. 25). Its two Rocketdyne boosters require pressure 165,000 lb. thrust each and the sustainer develops 65,000 lb. thrust.

Design features include a conical blunt nose cone to solve the re-entry heat problem and an external guidance



package, visible in some of the photos. Length of the nose section, including conical nose, is 9 ft.

Action Log

Washington—Here's the action announced by the U. S. last week as it battles to challenge the Soviet Union's technological propaganda bid.

- Outlined acceleration of Atlas intercontinental ballistic missile program. Administration will submit supplemental appropriation bill to Congress to cover the fiscal 1958 acceleration. Atlas launch for Fiscal 1958 will be approximately one-third greater than planned.
- Atlas test vehicle makes first successful launch.

• North Atlantic Council opens in principle with U. S. plan for equipping NATO countries with intercontinental ballistic missiles. Under the agreement, countries who do not want the missiles can refuse them although they may have agreed the agreement.



ANOTHER detail shows in final test of Atlas. Nozzle the show clearly.

Russians Study ICBM Deception By Fragmentation of Final Stage

Russian missile scientists reportedly are investigating a technique for mistaking their reconnaissance satellite asides in penetrate this country's missile defenses by confusing defending anti-missile units and computers with large numbers of decoy warheads.

Technique is to separate the missile's final stage, which leaves an exhaust smoke trail, from the rest of the missile, and to launch the fragments with a high explosive charge. Fragments will disperse for miles in front, behind and on all sides of the warhead, with many of the fragments making better radar targets than the warhead itself.

United States scientists developing the Army's Nike Zeus and Nike-X and the Navy's Aegis anti-missile systems have expected Soviet efforts in this direction and an extremely increased threat facing counter task forces. This has been handicapped, however, both by lack of knowledge and by systems played for security reasons on communications between groups working on closely related parts of the problem.

Counter Techniques

The problem of finding methods of countering decoy satellites is serious. At the extreme altitudes where the final stage would be fragmented, the view that solar hemisphere would not show the decoy fragments appeared.

This would maintain about the same relative velocity as the warhead until slowed by re-entry into the lower atmosphere about 75 mi. from the target. Also, they would be distributed over an area of several thousand square miles both forward and behind the warhead.

There are three approaches to countering this type of decoy.

• **Detection at re-entry.** The heavier mass of the warhead will cause it to maintain a higher relative velocity through re-entry. The problem here is of determining which target is the warhead and its interception point plus tracking and guidance of an autonomous missile against the warhead approaching from about 75 mi. away at a speed over 15,000 mph, are enormous.

• **Detection prior to decoy launching** if the approaching missile can be detected and tracked for long enough to compare its trajectory before fragmenting of the missile, the target following the original planned trajectory could be presumed to be the warhead. This technique, however, implies a degree of cooperation from the Soviets that is might not be reasonable to expect.

• **Detection by target analysis.** There have been several proposals both to the Army and Air Force as to methods for reducing solar hemisphere signals from targets to determine which target is the warhead. To do so, contrast has

been left for study of any of the various proposed counter techniques.

Soviet scientists have seriously handicapped the introduction of a formula between groups working on the anti-missile missile problem. At least one group of scientists attempting to solve the missile interception problem was not informed of Soviet's National Academy Committee for Aerospace reports, published since, that two years ago, that drastic methods for increasing and extending the range of warheads in striking the globe, potential of a new stage of speeds close Mach 5.

That first knowledge of these reports came after dissemination from an article appearing in *Aerospace Week* (Nov. 11, p. 26).

Sophistication Needed

A major point that would offset such counter as increasing contrast bulleting missile, would be the considerable development of an "anti-missile" by the Soviet Union. Dr. C. C. Toman told a recent meeting of the American Defense Association, "but a successful result would be so important that the project should be pursued regardless of all of the problems for the development of such a system have not been solved."

Scientists and military planners working on the problem of missile defense, say that much more study remains to be done. New and highly sophisticated techniques for detection, identification and guidance are mandatory. An effective missile defense system must increase in seconds the time between detection and destruction of any incoming intruder.



F11F Carries Sidewinder, Area Rule Tanks

New Corsair F11F-1B fighter, is shown carrying Sidewinder infrared air-to-air missiles and low drag, area ruled fuel tanks under the wing. The auxiliary fuel tank installation was specifically included as a part of the area rule application to the new model. Sidewinder weighs 135 lbs. is produced by General Electric and Philco, and is in experimental use.

Joint Atomic Energy Committee Asks Nuclear Plane Acceleration

By Katherine Johnson

Washington—Joint Atomic Energy Committee is still disquieted with the notion taken to develop the U.S. missile and nuclear propulsion programs. The more in conflict members of the first panel Congress will take in discussing defense policy in the coming session.

"Much more remains to be done," Rep. Carl Albert (D-N.C.), chair man of the committee, and Sen. Christian Anderson (D-N.M.), vice chairman, both said.

"This and however they were placed to suit a somewhat greater recognition by the executive branch of the challenges" posed by Russia's advances.

The committee specifically urged President Eisenhower to expand present programs for development of nuclear propelled rockets and aircraft.

Pointing out the military advantages of a nuclear-powered aircraft as a mobile platform for intermediate range missiles, the committee added:

"In terms of world opinion, the psychological advantage of getting the first nuclear propelled plane into the air would be great and perhaps crucial in American strategic posture."

The Administration recently followed the committee's recommendation in

accelerating control of nuclear aircraft projects under USAF Maj. Gen. Donald K. Ryan (AW Nov. 23, p. 20). But the committee and, further action "in improving program support for efforts to get a prototype flying as soon as possible" is necessary.

Rep. James W. Thompson (R-Conn.), a committee member pointed out that the new \$100 million was authorized under the nuclear aircraft program development program and the "which, project yet developed. It was a critical error." Thompson pointed to path for "a heretofore investigation" by the joint committee and growth of the Administration has to reduce the funds out from the atomic aircraft program to keep under a budget ceiling. This included a sharp reduction in the nuclear aircraft program, from \$100 to \$10 million (AW Aug. 19, p. 34).

The committee urged "full utilization" of the resources and facilities of the Atomic Energy Commission's Los Alamos and Livermore laboratories in the nuclear rocket development program and urged President Eisenhower to report on steps planned in this direction.

The need for additional facilities for production of atomic weapons also was emphasized. The committee urged that the Joint Chiefs of Staff serve in

method of estimating future requirements in order that these estimates be based on actual projected military requirements rather than being dependent upon AEC available production.

Meanwhile, two top leaders who in the atomic missile blast of votes reflected the divergent outlook in Congress.

• **Sen. Lyndon Johnson** (D-Tex.), majority leader and chairman of the Public Works Subcommittee, now moving forward with a comprehensive reauthorization of the nuclear-aircraft program (AW Dec. 2, p. 51) called for an all-out effort of agencies in stepping into the age of space.

• **Sen. Harry Flood Byrd** (D-Va.), chairman of the Finance Committee and a high ranking Democrat on the Armed Services Committee, continued against an "extravagance" that might affect the country's economic stability.

Continued, nuclear air would be needed expenditures over the next five years could be further increased without work being out economic in addition and by dangerous stimulating demands to national national production," Byrd warned. "We cannot afford to maintain this in military program"—an other program.

Johnson declared that "there is something much bigger and more important in front of us than a few years of military hardware"—such as missiles or jet fighters. "What is really before us is a new frontier—a new age. Rockets to the moon are just only the horizon. Space ships are only a few years away."

The scientists are already talking in terms of years about the day when we



Republic Developing Army SD-3 Surveillance Drone

Model depicts all weather SD-3 surveillance drone which is being developed by Republic Aviation Corp.'s Dayton Division for the Army Signal Corps under a \$5 million contract for development and production of the SD-3 and a more advanced jet version of the drone. "Which, is designed as an unmanned flying and spying machine and is called the first of its kind. Army says the SD-3 may advanced surveillance vision device and is equipped with three different color-developable area units for performing photography, radio or infrared missions. Drone can be launched at new heights with powered takeoff, and is reported to be convertible.

AIR TRANSPORT

Executive Losses Pose Threat to Capital

Departure of Austin may disrupt sales structure; discouraging financial outlook is blow to morale.

By L. L. Doty

Washington—Capital Airlines is redesigning a major top-level staff during that new work in the acquisition of at least five of the company's highest ranking sales offices.

The possible loss, in Capital's sales structure, is the direct result of the recent resignation of James W. Austin, its vice president for sales and sales to accept the presidency of Northeast Airlines (AW Dec. 16, p. 41).

Within 24 hours after Austin's resignation, Nelson F. Capitel, an assistant vice president for sales, announced his decision to follow suit and accepted an offer to join Northeast as vice president of traffic and sales.

At least three more of Austin's closest aides are known to be actively considering offers to move into top marketing positions within Northeast's sales department. Two other sales staff members have definitely declined to make the switch.

Austin Desires Role

Austin categorically denies that his shift at management level is behind his decision to take a significant part of his staff with him to Northeast. He told

Austin Weiss that he accepted the Northeast post because the carrier needs a "real sales job." It is to accept a well-paid job for a larger share of New England Florida traffic.

Austin is well known throughout the industry for his effective sales and joint marketing campaigns and is credited with having spearheaded Capital's introduction of the first domestic scheduled service in the U.S. He is an active participant in the acquisition of Capital's fleet of tri-jet, Viscount Viscounts and directed its advertising and sales programs that accompanied the inauguration of regular Viscount service.

Management Branch

During the past year, strong differences of opinion within the carrier's top management group have caused sharp breaches between sales departments, including sales. Discouraging financial prospects have intensified the strained atmosphere and at least one attempt was made to use executive losses the past six months to resign, a new public management position through a resignation of office risk.

Although any such move has been successfully rebuffed and management has pointed a crucial threat, internal

differences have filtered through to the outside, resulting in a lowering of personnel morale. The threatened departure of the sales staff members is symptomatic of a morale problem that began when it became evident the Viscount was not the machine it was expected to be.

Austin's leaving probably will not cause any significant change in management structure, but it will have a direct effect upon the company's sales program since, he is a highly motivated salesperson. As both a director and officer of the company, he has been a powerful force in Capital's growth pattern during the past 10 years.

However, present financial troubles have forced management to focus attention on major revenue generating efforts in operations and maintenance performance and to stress customer economy in other activities. The resultant discipline on sales activities has had an effect on Austin's influence in the management group.

Financial Hazards

Capital has now financial difficulties shortly after it began operation of its Viscount in 1971. That year the net loss was \$1.1 million, exceeding the gain on sale of equipment at \$1.1 million, or \$2.2 million, the following year, that figure had deteriorated into a \$1.7 million loss.

The airline now presents a \$71 million net loss for 1973, \$8.7 million in 1972 and \$10.9 million in 1970. If no additional equipment is added to its present fleet and the line structure remains the same, there are no plans for the purchase of additional Viscount equipment, although the airline would like to initiate into a program involving the acquisition of 16 turboprop Viscounts. An order for 16 de Havilland Canada was cancelled last year (AW Mar. 13, p. 38) because of an unwillingness to take on additional debt obligations at its present unprofitable earnings rate.

Capital does not yet intend to seek financing for the purchase of new equipment, although an attempt to renegotiate its Viscount lease with Balle Rovers and Videns Airlines under more favorable terms is under way.

The airline would like to dispose of its 12 Canadair CL-44s but has found no satisfactory market for them. However, proceeds from any such sale could be used for new equipment sales, under the terms of its present lease, the funds would have to be applied to the reduction of current indebtedness.

In a move to help revive Capital from its impending financial crisis, the board of directors last summer named USAF Maj. Gen. David Baker, retired, director of government and production for the Air Materiel Command, as the airline's president (AW July 23, p. 39). Former President J. H. Canadair had made director of the board.

Baker, then 61, has been unable to arrest the airline's downward financial trend and, under his appointment, Capital has been forced to request the Civil Aeronautics Board for a return to a viable status (AW Nov. 11, p. 39).

Baker is now directing all company activities. He has made no major changes in the airline's organizational structure and has successfully bolstered its individual but not sales power within the organization. Commercial contract to grade policy but, in contrast, Austin has sales a substantially less active part in the airline's operations. As yet, neither Baker nor Canadair is prepared to make any statement on the resignation of the sales department. It is unlikely that the sales department, once it is reestablished, will curb the influence within the hierarchy that it has under Austin.

Austin has consistently operated

under a rigid policy. For example, during the first six months of 1973, Capital spent .65 cents per passenger on advertising and publicity expense in comparison with \$1.02 per passenger for American Airlines. The airline spent on expenditures held Austin to his discipline, less than those used by American but he, nevertheless, was able to initiate a continuous respect in his promotional campaign.

Since Northeast operates under a strict budgetary policy, Austin apparently plans to reestablish a program at Northeast similar to his Capital program, using personnel who have worked under his leadership at Capital.

BEA, Industry Both Cool to Jet, Airline Will Soon Agree to Order

London—British European Airways decision on its 1974 short range jet transport is expected any day now after months of delay.

Choice will be made from among three final design proposals: British 200, submitted by British Aerospace Co., D01 121 from de Havilland Aircraft Co., and the Avon 740 from A. V. Roe and Co. Expected quantity of the order is about two dozen airplanes.

The prospective purchase presents a double paradox: BEA didn't positively want short range jets and British manufacturers don't particularly want to build them for BEA alone.

The airline has been finally wedded to the turboprop engine and BEA's Chairman Lord Macdonald Douglas has said that at one time BEA hoped to go on indefinitely with the turboprop

But BEA's head-on forced, first into purchasing specifications for its own short range jet and consulting three, and second, into having its de Havilland General 415 as a stopgap purchase until jets designed for its own needs would become available.

The manufacturers, stressed only that BEA might buy up to 24 airplanes designed specifically for the airline's network. BEA's reluctance to tackle the job Government refusal to subsidize the project meant that each company would have to invest about \$50 million in the development of the airplane and would have to sell about three times the possible BEA order to break even.

Other factors have dashed more cold water on the manufacturers' business attraction.

•Capital Airlines cancellation of its



DC-8 Jet Stresses Passenger Comfort

Three abreast rows of Douglas DC-8 jetliner's first class configuration are as wide as two abreast first class seats usually are on narrow-body jets. Blocking above and below, unobstructed overhead bins. Cold air outlets, dining lights and overhead call buttons are mounted on overheads in front of passengers. Upholstery padding maximizes floor when reclining seat is reclined. Passengers have reading lights set back in seat headrests.

Airline Income and Expenses—Third Quarter, 1957

(IN DOLLARS)

	Passenger Revenues	Mail Revenues (2 2)	Freight Revenues	Charter Revenues	Federal Subsidy	Total Operating Revenues	Total Operating Expenses	Net Income (Before Taxes)
DOMESTIC TRUNK								
American	370,323,282	11,337,473	54,246,634	3,051,529	211,117	439,226,751	472,161,199	\$4,999,552
Boeing	10,690,140	211,468	310,840	397,203	153,443	14,676,911	15,141,447	465,537
Capital	31,971,137	911,468	819,450	14,508	35,885,476	32,594,273	—	3,291,203
Continental	4,134,471	123,172	248,372	—	6,634,739	4,361,054	—	873,425
Delta	7,047,549	271,471	1,638,374	193,145	16,716,971	16,170,227	—	546,744
Eastern	33,653,821	911,468	1,157,734	3,779	15,462,143	33,420,144	—	367,449
Midwest	9,334,440	307,268	862,240	30,422	10,846,376	10,469,889	—	376,487
Northeast	4,613,650	161,791	161,134	4,519	4,948,297	5,158,647	—	—209,350
Northwest	14,458,330	379,723	2,029,237	8,176	18,865,343	18,476,819	—	3,888,524
Trans World	33,876,384	936,417	2,173,439	53,089	56,045,469	55,499,917	—	5,545,552
United	10,436,815	2,099,478	3,125,349	499,726	16,861,378	16,370,436	—	4,910,942
Western	16,436,730	292,441	423,494	14,138	17,457,944	17,558,437	—	9,000,481
INTEGRATED DALL								
American	1,372,333	16,126	312,441	—	3,493,399	3,493,399	—	291,174
Boeing	2,052,842	36,354	319,779	—	3,252,474	3,146,293	—	106,181
Continental-Battle	444,232	—	—	7,274	871,546	839,891	—	31,655
Delta	1,411,363	15,831	187,779	—	1,799,249	1,492,193	—	307,056
Eastern	3,371,407	76,344	174,843	103,437	3,926,447	4,080,259	—	—153,812
Northeast	765,911	13,229	68,455	11,791	779,844	771,447	—	8,397
Northwest	5,491,392	1,545,884	618,248	91,447	8,175,135	8,247,472	—	2,747,133
Trans American	1,424,848	39,314	176,692	41,443	1,749,914	1,712,422	—	37,492
Atlantic	55,974,172	1,495,430	2,176,146	815,204	41,223,432	31,876,484	—	9,346,948
Latin America	19,747,431	227,242	4,233,442	614,193	24,447,167	24,664,139	—	5,783,028
Pacific	16,631,546	1,918,861	9,156,179	1,186,864	31,176,871	30,473,207	—	7,003,664
Panagra	3,804,847	114,887	870,148	44,724	8,229,104	4,566,360	—	3,662,744
Trans World	17,143,191	1,227,457	1,205,819	243,883	26,377,291	26,299,247	—	7,878,044
United	4,497,438	97,309	63,722	17,200	4,675,661	4,776,444	—	99,217
Western	201,716	1,623	3,237	—	366,439	426,400	—	—59,961
LOCAL SERVICE								
Allegiant	1,247,424	33,801	82,755	—	303,620	5,767,609	3,148,545	—34,498
Boeing	587,009	1,363	17,447	91,089	109,410	872,046	749,294	122,752
Continental	498,000	11,000	72,000	29,000	27,000	1,496,000	1,146,000	350,000
Eastern	919,500	34,000	70,000	10,000	546,000	1,446,000	1,446,000	0,000
Pacific	493,218	1,100	14,000	—	255,214	733,801	607,600	126,201
Northwest	1,420,701	12,700	74,201	20,874	2,421,420	2,361,170	170,250	60,920
North Central	3,237,818	27,124	38,801	42,241	443,475	6,444,000	6,444,000	0,000
South	174,847	6,899	17,855	473,000	1,746,149	1,746,149	1,746,149	0,000
Southwest	1,412,700	25,977	31,722	14,848	453,339	2,244,146	2,082,876	161,270
Trans World	275,468	26,390	10,446	12,570	455,449	1,367,116	1,367,116	0,000
United	1,080,648	11,111	24,383	447,361	1,498,904	1,498,904	1,498,904	0,000
Trans World	872,507	38,737	33,821	14,131	745,363	1,728,147	1,644,479	83,668
West Coast	705,179	12,417	20,479	4,633	390,814	1,148,416	1,148,416	0,000
ALASKA								
Boeing	1,237,248	5,229	176,349	17,109	1,476,894	1,280,948	245,946	188,946
Trans-Pacific	784,401	6,903	30,242	5,579	494,546	494,546	494,546	0,000
GARBO LINE								
American and American	30,103	426,748	39,443	—	471,294	481,172	1,121	1,121
Flying Tiger	30,103	3,147,740	7,182,036	—	7,446,471	4,765,149	2,681,322	2,083,827
Boeing	33,453	1,414,376	41,455	—	3,419,219	3,419,219	—	—444,955
Boeing and Western	47,229	847,341	4,761,818	—	3,335,214	3,375,229	364,612	364,612
Boeing	—	1,411,625	8,154,475	—	6,947,469	4,444,444	2,503,025	2,503,025
HELICOPTER								
Chicago Helicopter	19,182	17,000	1,103	—	351,476	416,342	—	—41,650
New York Helicopter	33,471	30,379	20,499	5,047	342,167	373,213	16,056	16,056
New York Helicopter	140,811	14,172	12,301	16,405	557,364	566,468	8,900	8,900
ALASKA								
Alaska Airlines	476,321	124,448	324,717	245,282	278,740	1,476,448	1,505,433	—180,499
Alaska Central	552,444	24,447	34,751	44,842	75,267	441,467	374,471	67,996
Central	424,440	27,272	124,444	43,447	147,444	447,444	447,444	0,000
Boeing	325,144	14,444	34,444	43,224	346,441	346,441	346,441	0,000
Pacific Northwest	2,317,444	182,427	293,748	18,296	218,372	3,944,444	3,944,444	0,000

* Not available
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board



THE ROOT OF THE MATTER

Orenda is pioneering many new concepts in jet engine design.

The iROQUOIS supersonic turbojet, now producing over 20,000 lbs. (dry) thrust in its early development, incorporates several. The outstanding performance of the iROQUOIS, combined with inherent low weight, is the reason it has been selected for the Avro Arrow, Canada's new supersonic interceptor.

Multiside shows stress patterns in a jet engine blade root under load, using color photography and photo-elastic stress analysis.



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MISSILE ENGINEERING

Solid Fuels May Claim Big-Missile Field

By Russell Hovick

Rollbacks. Cold-Solid fuel rockets will play an important, if not dominant, role in the large missile field, according to most engineers and officials of Grand Central Rocket Co., Inc.

H. L. Thackwell, assistant president, points out that the only limit to the size and power of a solid propellant rocket is set by the means of transport from factory to pad. Even this limit could be overcome by building the case and casting the charge in the launching area, since relatively little manpower or floor area is needed.

Despite the size with which big solid propellant rockets can be built, Thackwell reports that multiple stages or clusters of rockets are a more probable response to demands for range, altitude and speed. Since growth factor in a rocket is the cube of its increase in payload (a propellant design, payload is anything not concerned with propellant) rather than a linear function as it is in a rocket, designers welcome the chance to drop all conventional restrictions thereby increasing the ratio of propellant weight to weight of payload in the later stages of powered flight.

Bucking a Trend

According to Charles L. Bartles, president of the company, Grand Central will back the current trend in the industry to develop "instant capsules" covering design and production of every component in the missile. The company's attitude is that formulation of its own propellant would cause competitors that would least tend to peek the best fact for the job rejection of its design.

To go into the aerospace or guidance business would be to compete with their own customers. Bartles explains that as a solid fuel, since the oxygen is doing quite well as a propellant replacement. At the moment, Grand Central is not seeking contracts for the design of a whole missile unless it is nearly all engine with only rudimentary guidance.

Outstanding progress of the rocket design, Thackwell said that with solid propellants it would be possible to put an American rocket in the moon within a year. In five years, a manned satellite could be in orbit and an orbital rocket could hit Mars. A manned, solid fuel rocket could be on the moon in 10 years.

A trend toward solid propellants for big rockets is beginning to surface. Chief reasons for this are the military advantages offered by:

- **Reliability.** Once through its development program, a solid propellant rocket can be expected to give virtually 100% reliability.
- **Economy.** The result of good reliability is a cut in the number of rockets which must be produced to destroy a target.
- **Ease of handling.** The simplicity is given due to a smaller list of ground equipment required, smaller manpower requirement, lower parts to be maintained, etc.
- **Short countdowns.** A solid fueled rocket stands on the pad in being can detect if an initiate system malfunctions or seconds of the first detection of an attack. This minimizes the danger of its being destroyed on the pad. Developable liquid propellant rockets intended to fire the same advantage are waiting progress in the laboratory, but are not expected to reach an operational stage for some time.

Less well known than these advantages is the fact that solid propellants can at least compete in performance with liquid propellant rockets of not com-

peted sizes. Thackwell points out that solid fueled rockets hold the speed and altitude records on this side of the Iron Curtain.

It is true that liquid propellants have a margin of specific impulse in their favor but this gap has narrowed in recent years. Also, when the proportion of payload to propellant weight is small (95% or less), performance is less, regardless of changes in the mass ratio (propellant weight to gross weight minus propellant) than to changes in specific impulse.

The reason for this is evident in the formula for dry-flight burnout velocity in horizontal flight:

$$V_b = I_{sp} \log(1 + W_p/W_r)$$

The burnout velocity, V_b , is a direct function of I_{sp} , the specific impulse, and a logarithmic function of W_p/W_r , the mass ratio.

Ratio Advantages

The advantage of solid fuel rockets in mass ratio is due to two things: solid propellants are usually about 75% denser than liquid propellants, and the inert weight of propellant accessories like fuel pumps and controls and control systems is not needed. Thackwell points that the biggest strides in solid



BRAMLEY-BEARD propellant motor being handled at Grand Central's Rollback plant cost \$100,000, is said to be largest in design that will be in operation by mid-July.